With the environmental pollution norms becoming increasingly stringent, there is a need for alternate combustion techniques and alternate fuels to keep up with changing trends. One of the viable solutions for India is adaptation of methanol as a fuel for automotive sector. Methanol could be produced from stray carbon such as high ash coal, municipal solid waste (MSW) and low value agricultural biomass, and it can be potentially a good substitute for imported petroleum-based fuels. Methanol has higher Octane number, and emits Lower Hydrocarbon and NOx. Engine noise and vibrations of methanol-fuelled engines are also relatively lesser than equivalent petrol engines. Further, better fuel properties of methanol lead to higher engine efficiency, which in turn lead to higher well-to-wheel efficiency vis-à-vis gasoline. In this study a functional two – wheeler prototype was developed which uses M85 (85% v/v methanol + 15% v/v gasoline) in an ECU controlled port fuel injected engine. Various strategies of methanol utilization in this two–wheeler engine were evaluated. Finally, a retrofitment kit for existing PFI two-wheeler with minimal structural changes was developed for successful M85 adaptation. This thesis describes entire process of ECU recalibration for methanol utilization. In addition, a comparative study was performed for simulated on-road two-wheeler performance on chassis dynamometer using a gasoline fuelled motorcycle with stock ECU vis-à-vis M85 fuelled motorcycle using recalibrated ECU, followed by comparison of emissions.